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ORIGINAL ARTICLE

Geomorphological Heritage as a Tourist Attraction. A Case Study in Lubelskie Province, SE Poland

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Abstract Within Lubelskie province (SE Poland) are several regions notable for groups of landforms unique in Poland. In this paper, tourists' assessments of the geomorphological heritage of the region have been analysed. The most interesting sites, from both the scientific and touristic points of view and also proposed for the national list of geomorphosites, were chosen for the study. The evaluation by tourists was carried out by means of an Internet survey with 693 answers collected over 6 weeks. The sites visited most frequently by the respondents are loess gullies and river valleys with small waterfalls. The sites were mostly visited during car trips and as part of walking excursions during a long-term stay. The main motivation for visiting the surveyed sites was the aesthetic value of the landscape. The respondents sought information, mainly on the Web, about nature, culture and tourist attractions. The results of the survey indicate a need for further promotion of the geotouristic values of lesser-known sites in Lubelskie province and this will also enable tourism to be better managed.

Keywords Geomorphological heritage · Geomorphosites · Geotourism · SE Poland · Tourism

Introduction

The Lubelskie administrative province is characterised by diverse relief and geological structure. In the upland areas, the relief, along with its geological characteristics, can be regarded as the main factor forming the landscape and gives the region its attractiveness to tourists. Some sites of geomorphological heritage are located within areas of concentrated tourist traffic, while the remaining sites can be found in areas characterised by poor tourist infrastructure and low traffic. Those interested in geomorphological heritage typically head for the Carpathians and Sudetes. That is why, in general, Lubelskie province stays outside the scope of the geotourist's interest.

Geomorphosites and geomorphological landscapes are significant features of geomorphological heritage from the perspective of tourism. Geomorphosites are relief forms characterised by high scientific, cultural, ecological and aesthetic values (Panizza 2001). According to Reynard (2005) 'a geomorphosite is a landform to which a value can be attributed', while 'the geomorphological landscape is a portion of the Earth surface, which is viewed, perceived, and sometimes exploited by Man'. Each geomorphological landscape has scientific, cultural, ecological, aesthetic and economic values. The values of the abiotic environment have long been attracting tourists (Migoń 2009; Reynard and Coratza 2007; Feuillet and Sourp 2011). Growing attention has been directed at geological and geomorphological sites contributing to the conception of a new form of tourism—geotourism. The first definition was proposed by Hose (1995): 'The provision of interpretive and service facilities enabling tourists to acquire knowledge and understanding of the geology and geomorphology of a site (including its contribution to the development of the Earth sciences) beyond the level of mere aesthetic appreciation'. Geotourism constitutes a 'branch of cognitive tourism and/or focused at experiences, based on discovering geological sites and processes, as well as receiving aesthetic impressions in contact with them' (Słomka and Kicińska-Świderska 2004). According to Newsome and Dowling (2010), 'Geotourism is a sustainable tourism with a primary focus on experiencing the earth's geological features in a way that fosters an environmental and cultural understanding, appreciation and conservation, and is locally beneficial'. Crucial

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for the development of this form of tourism are the geological and geomorphological values of the area. The highest potential is in areas of diverse geological structure and relief. The sites have to represent to a certain degree the aesthetic value and expressiveness of the relief.

An evaluation of the importance of geomorphological heritage has to take into account scientific criteria, which are usually easier to judge, as well as socio-cultural ones (Pena dos Reis and Henriques 2009; Bruschi et al. 2011). The result of the evaluation depends not only on the characteristics of the local terrain, but also on the evaluator—his sensitivity, culture, education and attitude towards the evaluated terrain (Lothian 1999). The application of this approach is the basis of research on scenic landscape assessment, where photographs are frequently used, serving as a substitute for the evaluated landscape (Zube et al. 1982; Hull and Buyhoff 1984; Clay and Daniel 2000). This method can also be used to assess the geomorphological landscape because relief of the land is the most important landscape component in upland areas. In tourists' perception of geomorphological heritage, a significant role is played by the aesthetic and scenic values of sites (Quaranta 1993; Zgłobicki et al. 2005; Papińska and Białkowska-Jelińska 2010). The high aesthetic value of many areas results from the high value of the natural environment (Zgłobicki et al. 2005). In 2007, the Association of Polish Geomorphologists prepared a list of geomorphosites (45 in total) representing the diversity of relief in Poland (Migoń 2008). Publishing a site (on the WWW or in a monograph) may lead to the protection and development of educational material as well as improving its attractiveness to tourists because of the availability of information on the site and tourist facilities. Six sites were proposed from the studied area: Vistula River Gap, an escarpment in Dobre, loess gullies in the Kazimierz Dolny area, karst regions of Chełm Hills, Podlaski Bug River Gap near Mielnik and gap sections of rivers in the Tomaszów Roztocze (Zgłobicki et al. 2007). Additionally, a work in progress is the conceptual idea for national geoparks: the Małopolski Vistula Gap Geopark and Stone Forest Geopark in Roztocze Region. Three geomorphosites (Vistula River gap, escarpment in Dobre and loess gullies in the Kazimierz Dolny area) are within the planned Małopolski Vistula Gap Geopark. One site—gap sections of rivers in the Tomaszów Roztocze—is proposed for the list of European Geosites (Alexandrowicz 2006).

In this paper, an effort has been made to estimate the knowledge of actual and potential tourists for the selected geomorphosites and for specific types of geomorphological landscape. Data concerning the familiarity of tourists with Poland's geomorphological heritage are very limited. The most interesting sites, from both scientific and touristic points of view, were chosen for the study. The study focused on the sites proposed for the national list of geomorphosites and partly located within the area of future geoparks.

Area of Study

From the geological perspective, the Lublin region has a very interesting location since three of Europe's vast tectonic provinces come into contact here: the Precambrian Eastern European platform, the Palaeozoic Western European platform characterised by a very complex internal structure and an area associated with Mesozoic/Cenozoic orogenic movements in the Alpine Megacycle. Each of these huge tectonic provinces underwent a different, complex evolution manifested both in the surface geological structure and, in part, in the diversity of landforms (Harasimiuk 1980; Harasimiuk et al. 2008).

Upper Cretaceous rocks, between 350 and 1,000 m thick, play the most important role in the geological structure of the study area (Harasimiuk 1980). They have developed as chalk, marl, limestone and siliceous carbonate rocks ('opokas') and are overlain by up to 50 m of Paleogene and Neogene rocks. The Upper Cretaceous and Paleogene rocks are covered by glacial deposits, i.e. glacial till and sand, occurring in the form of patches of varying thickness (0–100 m). The younger component of the Pleistocene depositional sequence is represented by loess associated primarily with the Weichselian glaciations (Maruszczak 1995). The loess does not form a continuous cover but occurs in the form of patches up to 30 m thick (10–15 m on average).

The complex geological history of the area resulted in diverse bedrock and cover deposits and, consequently, the typological and stratigraphic diversity of the relief. Most of the study area is characterised by mature relief whose general outline had already developed by the Neogene or even the Paleogene. In some places, Pleistocene and even Holocene processes and sediments played an important role in the development of this relief (Rodzik et al. 2008). Upland relief developed on three different lithological types: siliceous rocks, rocks undergoing karst processes, and loess. Siliceous uplands developed within consolidated rocks with considerable silica content (sandstone, siliceous carbonate rocks—'gaize', 'opoka'). They are characterised by mature relief characterised by large forms, with vast gently sloping ridges interspersed with troughs and denudation valleys. The silica/carbonate subtype ('gaize' and 'opoka') occurs in Lubelskie province. The subtype of rocks undergoing karst formation is not very common in the study area but occurs as consolidated rocks (limestone, marl and chalk) which are easily dissolved or eroded. It is characterised by rather small differences in elevation and vast gently sloping denudation forms with the addition of secondary karst

forms. Nearly one third of the province's upland area is occupied by the loess type, developed on loess cover up to 30 m thick. Loess relief is distinguished by considerable fragmentation of convex/concave slopes, considerable differences in elevation and a usually dense network of Holocene erosional forms (Rodzik et al. 2008).

Using the geographic regions according to Kondracki and Richling (1994), Lubelskie province is located at the border of Western and Eastern Europe, within five geographical provinces: Central European Lowland (South Podlasie Lowland), Polish Uplands (Lublin Upland and Roztocze), Carpathian Foredeep (Sandomierz Basin), East Baltic Sea Lowland (Western Polesie, Volhyn Polesie) and Ukrainian Uplands (Volhyn Upland, Pobuże Basin). From the geomorphological perspective, the southern and central parts of the province are the most interesting (Harasimiuk et al. 2008).

Some of the geotourist sites are under various forms of protection. The following have been established within the province: 2 national parks (Poleski NP, Roztoczański NP), 85 natural reserves, including 2 geological reserves (parts of the other reserves also have high abiotic values), and 1,387 natural monuments (including 33 springs, 26 erratics, 5 geomorphological forms, and 2 outcrops). Other legally protected areas are less focused on the protection of abiotic environments due to the nature of the designation: 17 landscape parks, 17 areas of protected landscape, 182 ecological sites, and 7 landscape–nature protected complexes (Regional Directorate for Environmental Protection in Lublin).

In the upland areas of Lubelskie province, some interesting geomorphological sites on a national level, as well as an international level, can be found (Alexandrowicz et al. 1992). Among them are numerous forms of pre-Quaternary relief—deep river valleys cut into Cretaceous bedrock, sometimes having a gap character, as well as clearly distinguished structural escarpments. The loess-covered areas are characterised by high relief, high relative heights, steep slopes and a dense network of dry valleys and gullies (Zgłobicki et al. 2007). The most interesting geomorphological sites in the region include: a dense gully network up to 10 km km^{-2}, chalk karst forms, gap sections of large and small rivers, structural relief forms and natural valleys of large rivers. The sites selected for detailed study can be divided into three categories (Fig. 1):

(a) single geomorphosites or groups of them: escarpment in Dobre and the Tanew, Szum and Sopot river valleys;
(b) areas where numerous geomorphosites with similar characteristics occur: loess gullies in the vicinity of Kazimierz Dolny, hills and gullies in the vicinity of Szczebrzeszyn and the Chełm Hills–Rejowiec Fabryczny area;
(c) vast river valleys encompassing various geomorphosites: Małopolski Vistula River Gap and the Bug valley (Dubienka–Włodawa section).

Studies on the perception of geomorphological heritage were thus conducted for individual geomorphosites (where possible) or within particular geomorphological landscapes.

The *Małopolski Vistula River Gap* is one of the most interesting river valley sections in Poland. The length of the gap section is about 80 km, and the width of the valley bottom varies from 3 to 10 km in southern and central parts. The section between Janowiec and Kazimierz Dolny is a deep (60–80 m) and narrow river gap (Fig. 2a). Additionally, it is possible to observe the influence of hydraulic action on the contemporary functioning of the river channel—shoals, outwashes and anthropogenic flood terraces (Warowna 2010). The Vistula valley in the Kazimierz Dolny area is characterised by intense tourist traffic.

The most interesting—from a geomorphological and tourist point of view—are gullies in the western part of the *Nałęczów Plateau* (Fig. 2b). In some parts of the region, the density of the gully network is over 10 km km^{-2}, which is unique in Europe (Maruszczak 1973). The dense network of gullies occurs over an area of more than 40 km^2. The western part of the Nałęczów Plateau, along with the Vistula river valley, is protected within the Kazimierz Landscape Park. Gullies in the Kazimierz area are visited by many tourists.

A few kilometres to the south, there is another interesting site of high visual value—the *escarpment in Dobre* (nature reserve). It is a steep morphological form of tectonic origin (a cuesta), with a height of up to 80–90 m (Fig. 2c). The escarpment is a perfect vantage point for overlooking the Vistula valley and the Chodel Basin. Its value is additionally increased by deep gully dissections (Kołodyńska-Gawrysiak et al. 2010).

Chełm Hills is a region that is unique nationally, featuring surface forms of Neogene and Quaternary karst: sinkholes, uvalas, karst valleys, polje basins, as well as palaeokarst landforms of various ages exposed in quarries in the vicinity of Rejowiec and Chełm (Fig. 2d). The relief of this area is enriched by inselbergs, as well as a group of marginal forms of the Odra glaciations (Dobrowolski 1998). The area is visited by few tourists and is not well-developed in terms of tourism.

Szczebrzeszyn Roztocze, the eastern part of *Goraj Roztocze*, is a homogeneous area between Wieprz and Gorajec river valleys, covering about 60 km^2 (Fig. 2e). The diversified land relief gives rise to the high attractiveness of the landscape, protected within Szczebrzeszyn Landscape Park. The very dense network of gullies (8–10 km km^{-2}) in the central and northern part of the region could be developed as geotouristic points of interest within the existing tourist routes. The longest gully systems have a total length of more than 10 km, and the deepest forms reach the depth of 20–25 m (Brzezińska-Wójcik and Harasimiuk 2010). The intensity of the tourist traffic in this area is low.

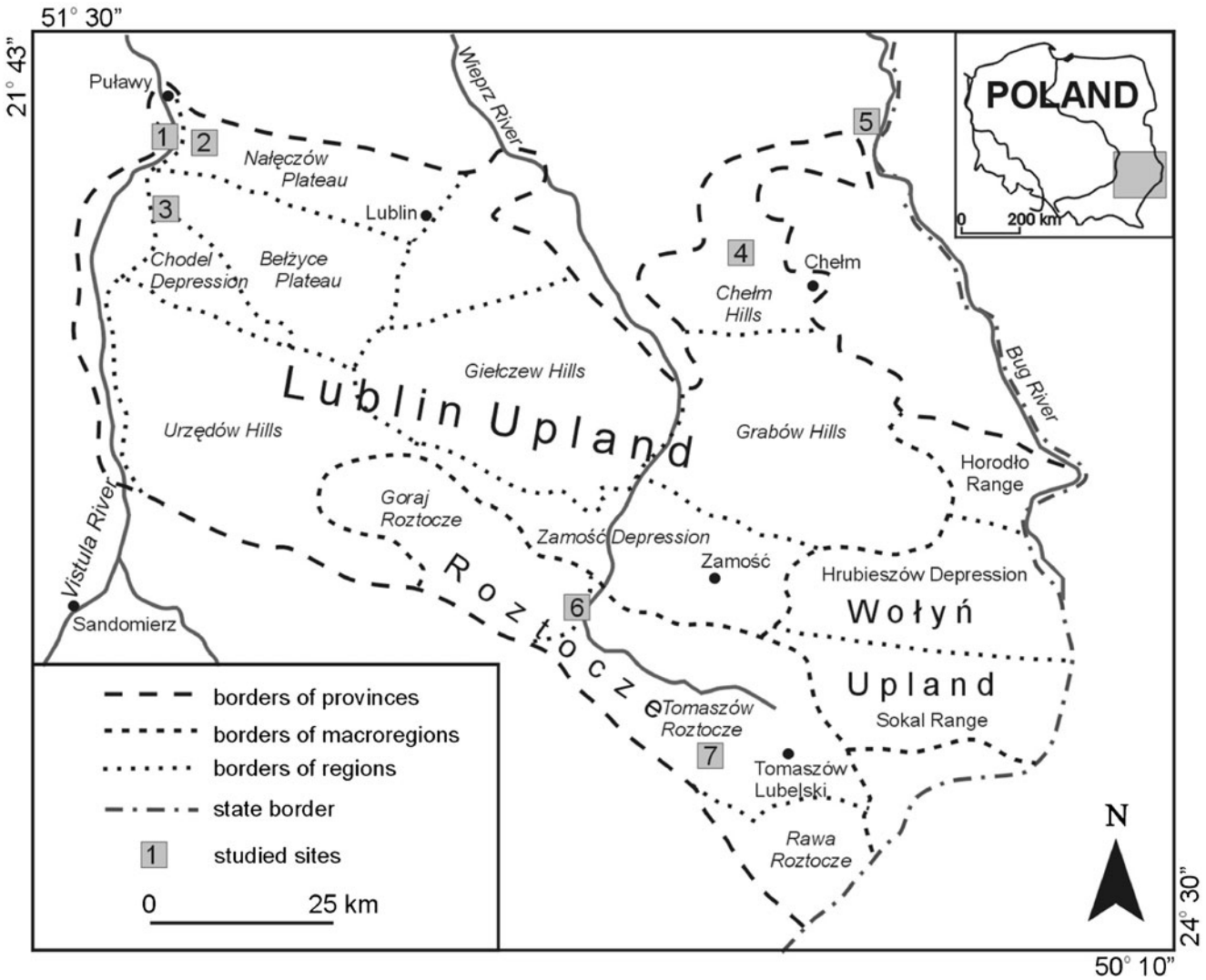

Fig. 1 Location of the studied geomorphosites against geomorphological regions (after Maruszczak 1972). *1* Małopolski Vistula River Gap, *2* loess gullies in the vicinity of Kazimierz Dolny, *3* escarpment in Dobre, *4* Chełm Hills, *5* Bug river valley, *6* hills and gullies in the vicinity of Szczebrzeszyn, *7* Tanew, Szum and Sopot river valleys

The edge zone of the *Tomaszów Roztocze* is dissected with rivers forming gap valleys with rocky cascades (cataracts) in the riverbed. Szum, Sopot and Tanew river valleys are narrow and deeply cut (10–20 m). Numerous cascades occur within channels with heights ranging between 0.5 and 1.5 m (Fig. 2f). The region is characterised by a well-developed network of tourist routes and places to stay. The river valleys, especially the Tanew valley, are visited by large numbers of tourists, and their geomorphological and landscape values clearly increase the overall tourist attractiveness of the region (Brzezińska-Wójcik and Harasimiuk 2010).

The Bug is one of a few large rivers in Europe which have retained their natural character and have not been significantly affected by human interactions so far. In the section analysed in this paper, the Bug meanders intensely and is accompanied by numerous scrolls—remnants of old meanders (Fig. 2g) (Turczyński et al. 2006). In places where the valley cuts into subsequent geomorphological units, picturesque gaps have been formed. This area is relatively rarely visited by tourists; the tourist traffic is concentrated mostly in the neighbourhood of the historical towns which are the major tourist attractions.

Questionnaire surveys concerning knowledge about the geomorphological heritage of Lubelskie province have not been conducted so far. Only a few studies have been published characterising the geological and geomorphological sites of part or the whole of the province and the opportunities for developing geotourism (e.g. Zgłobicki et al. 2007, 2012; Brzezińska-Wójcik et al. 2009; Dobek 2011; Harasimiuk et al. 2011). Globally, few studies have been published devoted to the expectations of tourists with

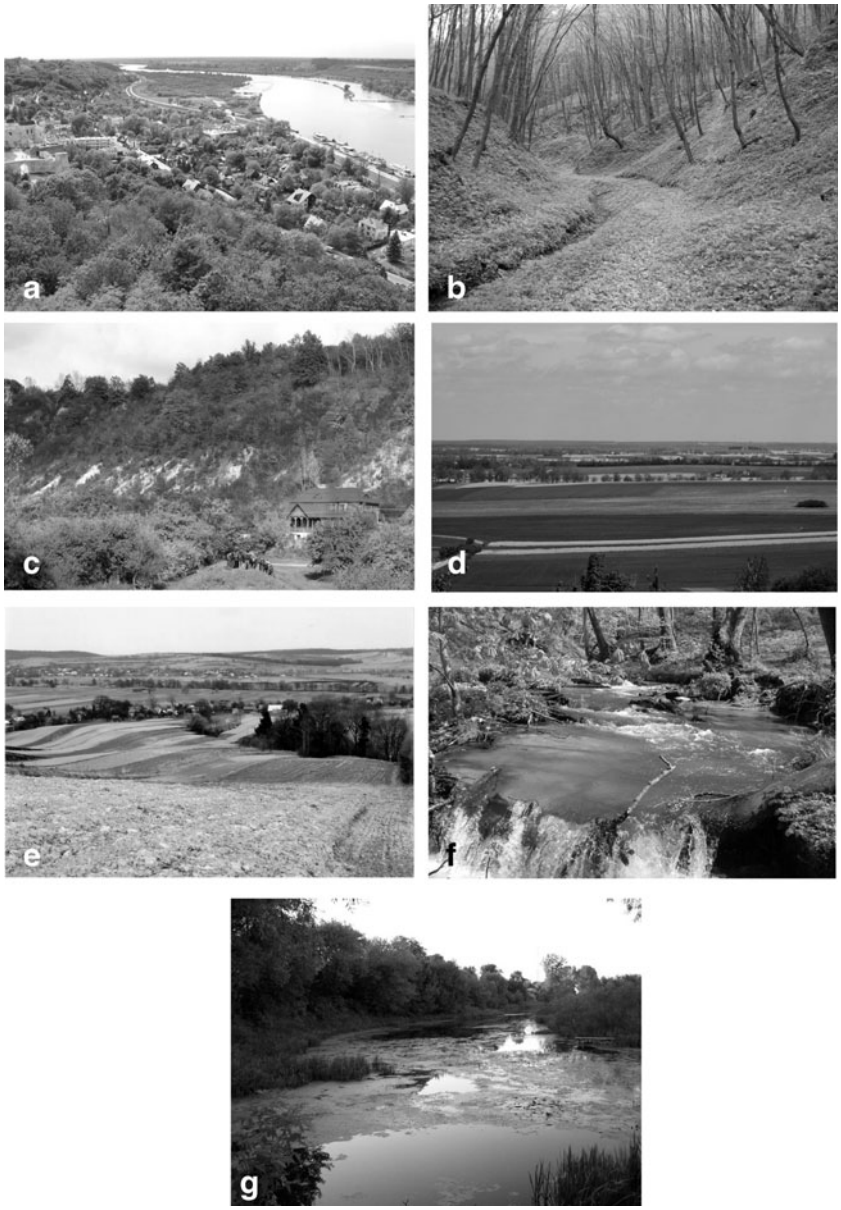

Fig. 2 Studied geomorphosites and geomorphological landscapes. **a** Małopolski Vistula River Gap near Kazimierz Dolny, **b** loess gully in the vicinity of Kazimierz Dolny, **c** escarpment in Dobre, **d** Chełm Hills, **e** hills and Wieprz river valley close to Szczebrzeszyn, **f** waterfall in the Sopot river valley, **g** Oxbow lake of Bug river

regard to geomorphological heritage; see a review by Reynard (2008).

Method of Study

The perception of geomorphosites was studied by means of an online survey consisting of nine questions (Appendix). The data analysed in the survey concerned the following: familiarity with the studied sites (i.e. previous visits to these sites), intention for future visits, motivation and character of the trips and level of environmental knowledge. The respondents were also asked to rate the attractiveness of natural sites presented on photographs (question no. 8). The last part of the survey consisted of demographical questions, collecting data on gender, age, education and location of the respondents. The main advantages of an online survey are speed of data collection, anonymity and ability to reach a large and diverse population at low cost (Zgłobicki et al. 2005). A growing number of publications state that online surveys are an objective and credible method of collecting data in landscape studies (Wherrett 1999; Roth 2006; Lange et al. 2008).

The request to complete the survey was sent to 15 usenet mailing groups, 70 % of which were regional groups, and the remaining ones belonged to pl.rec (recreation) hierarchy, e.g. *pl.rec.foto* (*photography*), *pl.rec.gory* (*mountains*), *pl.rec.kajaki* (*kayaking*). The Web users were asked to complete a survey prepared in connection to a research paper, and they were not informed about the exact aim of the survey. An IP block was applied to prevent multiple voting. The data was collected in March–April 2009.

Results

An analysis of the results was performed on the whole population of respondents, as well as separately for Lubelskie province, Mazowieckie province and the group of Małopolskie, Śląskie, Wielkopolskie and Dolnośląskie provinces (with a considerable number of respondents, in provinces of similar character). The survey was completed by 693 respondents. The predominant group of respondents were male (89 %), aged 20–40 (60 %) and with a university degree (69 %). As for geographical distribution, the largest group came from Lubelskie (35 %), Mazowieckie (22 %), Małopolskie (12 %) and Śląskie (8 %) provinces. A lower number of responses came from neighbouring provinces: Podlaskie (1 %), Podkarpackie (3 %) and Świętokrzyskie (2 %).

The studies conducted show that most of the respondents paid at least one visit to the areas in Lubelskie province where interesting geomorphological heritage occurs. Such an answer was given by more than 55 % of the respondents in four out of seven cases. This indicator was below 20 % only in one case.

[Appendix, Q1] The part of Lubelskie province that is best known and most frequently visited, according to the survey, is the area of Kazimierz Dolny and Nałęczów—75 % of the respondents. On the other hand, only 29 % visited the eastern part of the region—the Chełm area and the Bug valley.

[Appendix, Q2] The most frequently visited geomorphosites are the loess gullies near Kazimierz Dolny, less popular are the gap valleys in Tomaszów Roztocze. The least known sites include the escarpment in Dobre and the karst landscape areas near Chełm and Rejowiec Fabryczny (Table 1). Of the respondents, 20 % has not visited any of the sites mentioned in the survey, but among respondents living in Lubelskie province, it is only 2 %.

[Appendix, Q3] The studied sites were usually visited during car trips (37 %), as a part of walking excursions during a long-term stay (23 %) and on short bicycle trips (16 %). These data were different for various provinces, e.g. Lubelskie—short bike trips 25 %, Mazowieckie—walking excursion during a short-term stay 40 %, group of provinces—walking excursions during a long-term stay 50 % (Table 2).

[Appendix, Q4] The main motivation for visiting analysed sites was landscape values (sights)—60 %. Significantly less important were environmental (21 %) and cultural (11 %) characteristics. The respondents completely ignored the role of good tourist infrastructure as a motivation for visiting a given place—only 1 % recognised it as an important factor.

[Appendix, Q5] Answering the questions on the origin of six selected types of geomorphological forms, the respondents claimed that they best knew the origin of meanders (86 % positives), loess gullies (64 %) and river gaps (56 %). As many as 21 % of the respondents declared they knew the origin of structural escarpments. The responses were similar in all provinces.

[Appendix, Q6] The main sources of information on the environment, culture and tourist attractions used by the respondents were (Table 3) the Internet (60 %) and tourist guides (26 %). A mere 7 % of the respondents never seek such information. Of interest is the high percentage of respondents seeking information in tourist guides in Mazowieckie province (46 %)—only slightly lower than the Internet (51 %). About 77 % of the respondents from Lubelskie province declared they use the Internet to seek tourist information.

[Appendix, Q7] The majority of the respondents expressed an intention to visit the following geomorphosites: loess gullies near Kazimierz Dolny, valleys of the Tomaszów Roztocze and the Bug river valley (Table 4). The escarpment in Dobre and the Chełm Hills clearly enjoyed a smaller interest.

[Appendix, Q8] In the case of an evaluation of the touristic attractiveness of a site, there is a strong correlation between a 'high rating (strong willingness to visit)' and the photograph itself (aesthetic values in the picture). In the category 'definitely would like to visit' the sites presented on the photographs, the answers varied from 9 % (Chełm Hills) to 58 % (loess gully, Sopot falls). Familiarity with a given site is positively related to the intention to revisit it—the percentage is on average 24 % higher in comparison to respondents who had not previously visited the site. A reverse relationship is observed only in the case of the Chełm Hills—where the declared intention to visit is more frequent among respondents who are not familiar with the region (Fig. 3).

Table 1 Percentage of respondents who visited the analysed geomorphosites

	The whole studied population [%]	Lubelskie province [%]	Mazowieckie province [%]	Other provinces [%]
Małopolski Vistula River Gap	25	18	39	24
Loess gullies in the vicinity of Kazimierz Dolny	65	85	90	41
Escarpment in Dobre	13	21	10	11
Hills and gullies in the vicinity of Szczebrzeszyn	35	46	50	22
Chełm Hills	19	34	20	6
Tanew, Szum and Sopot river valleys (Tomaszów Roztocze)	46	70	55	28
Bug river valley	29	40	26	17

[Appendix, Q9] Of the respondents, 34 % took more than 20 photographs during trips to the geomorphosites under study, while 26 % took 5 to 20 photographs. Seven percent of tourists do not take photographs, and the same number took fewer than five photographs.

[Q3 and Q5] Greater familiarity with geomorphological terms (declared knowledge of origin) was found among respondents who visited the sites as part of hiking trips during a longer stay (62 %). For bicycle trips, the percentage is 41 %, while for car trips, the percentage is 44 %.

[Q3 and Q7] A more frequently declared intention to visit a site can be found among respondents who visited them during bicycle trips than among those who chose hiking trips (Fig. 4).

[Q4 and Q5] There is a higher claimed knowledge of the origin of geomorphological forms among respondents who prefer environmental values (59 % of positive answers) than among those who prefer cultural values (46 %).

[Q4 and Q7] Opinions (declared intention to visit) about the studied sites are better among respondents appreciating landscape (59 %) rather than cultural (50 %) values. However, the difference is small.

[Q5 and Q6] Better knowledge on the studied sites is held among respondents who seek information in scientific publications (35 %) and tourist guides (36 %), while respondents who mainly use the Internet for this purpose are less knowledgeable (28 %). Even more clearly visible is an acquaintance with geomorphological terms among respondents declaring usage of scientific publications as a source of information (79 %) rather than among the Web users (21 %).

[Q6 and Q7] There is no significant correlation between source of information and opinion about the site (declared intention to visit)—52–60 %. Only among respondents who declared they do not seek information of any source is it significantly lower (35 %). Familiarity with a site adds 10–30 % to the opinion about the site (declared intention to visit), and the most significant difference is in the case of the Małopolski Vistula River Gap at 34 %.

Table 2 Tourism types exercised by the respondents while visiting the studied sites

	The whole studied population [%]	Lubelskie province [%]	Mazowieckie province [%]	Other provinces [%]
Short bicycle trip	16	25	3	8
Walking excursion during a short-term accommodation	17	15	32	23
Walking excursion during a long-term accommodation (over 2 days)	23	6	22	19
Car trip	37	50	40	50
Other	7	4	3	0

Table 3 Sources of information on the subject of environmental, cultural and tourism values of visited sites

	The whole studied population [%]	Lubelskie province [%]	Mazowieckie province [%]	Other provinces [%]
Scientific and popular science publications	5	2	3	11
Tourist guides	26	15	46	25
The Internet	60	77	51	55
I do not seek such information	7	6	0	9

The percentage of people who had visited the studied sites is higher among older respondents. Younger respondents more frequently declared bicycle trips as a way of visiting the sites. In other age groups, car trips (25–40 years old) and walking excursions during long-term stays (40–60 years old) are more popular. There is clear correlation between the source of information and the age of the respondents—older people more frequently refer to tourist guides and are not using the Internet as often as young people (Fig. 5). In the group of respondents aged below 25, there is a high percentage of respondents who never seek information about the sites they visit—16 % (in comparison with 7 % in the group aged 25–40 and 0 % in the group aged 40–50). The survey shows education to be highly relevant. The lowest familiarity with the studied sites is among students, and at the same time, students point to the Internet as their main source of information (76 %), while among respondents with a university degree, it is 58 %. Respondents referring to tourist guides as their main source of information are 6 % among students, 17 % among secondary school graduates and 30 % among respondents holding a university degree. The number of students who are not seeking any information on the sites (11 %) is twice as high as respondents from the other groups. In the case of an opinion about the attractiveness of the photographs, a higher percentage occurred among respondents with a university degree.

Discussion

The best known and the most interesting landforms for tourists are gullies—forms that result from indirect human impact on the environment, i.e. deforestation (Zgłobicki and Baran-Zgłobicka 2011; Dotterweich et. al. 2012). The situation is partly similar to the case of geological heritage: outcrops in quarries in some areas are more valuable and more interesting to tourists than natural outcrops (Alexandrowicz and Alexandrowicz 2002). However, tourists do not usually know the relation between agriculture and gully erosion and recognize gullies as natural landforms.

In light of the data obtained, scenic (aesthetic) and environmental values are the main motivation for visiting geomorphosites and interesting geomorphological landscapes. Tourists visiting the Alps also preferred scenic and environmental values (Pralong 2006). In studies on Polish national parks, the highest ranking was given to mountain national parks characterised by varied landscape (Zgłobicki et al. 2005). Among tourists visiting Łuk Mużakowa Geopark (W Poland), the most frequent motivation for visiting was the desire to learn more about nature (34 %), while

Table 4 'Evaluation'—declared intention to visit studied geomorphosites

	The whole studied population [%]	Lubelskie province [%]	Mazowieckie province [%]	Other provinces [%]
Małopolski Vistula River Gap	52	51	53	55
Loess gullies in the vicinity of Kazimierz Dolny	75	75	73	84
Escarpment in Dobre	41	30	53	40
Hills and gullies in the vicinity of Szczebrzeszyn	58	67	73	44
Chełm Hills	60	61	66	52
Tanew, Szum and Sopot river valleys	65	71	63	64
Bug River valley	63	61	63	64

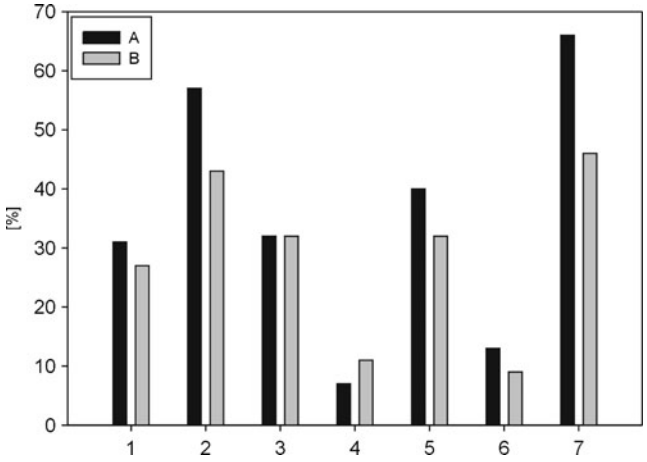

Fig. 3 Familiarity with the sites versus 'strong willingness to visit' the site presented on the picture. *1* Małopolski Vistula River Gap, *2* loess gullies in the vicinity of Kazimierz Dolny, *3* Bug river valley, *4* Chełm Hills, *5* escarpment in Dobre, *6* hills and Wieprz river valley close to Szczebrzeszyn, *7* waterfall in the Sopot river valley, *A* individuals who have visited the site before, *B* individuals who have never visited the site

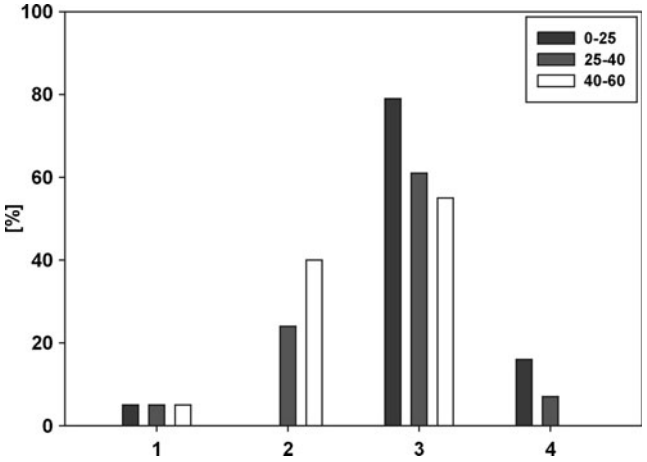

Fig. 5 Age versus sources of information on the sites visited. *1* scientific publications and popular science publications, *2* tourist guides, *3* Internet, *4* I do not seek such information

43 % of the respondents indicated environmental values as the main tourist asset of the park (Sołogub 2008). Research made by Wójtowicz (2011a) showed that geography students rate very highly the tourist assets of valuable geological and geomorphological sites in Kielce (Świętokrzyskie Mountains area).

Geomorphological heritage sites are usually visited during visits to well-known tourist destinations. Interesting geomorphosites are little known even though they are located quite close to the tourist centres (e.g. the escarpment in Dobre).

The desire to discover the assets of inanimate nature is rarely the main goal of trips. For example, this motivation is declared only by a few percent of those visiting the geological reserves in Kielce, while 50 % declare the opportunity for leisure as an important motivation (Wójtowicz 2011b). Studies by Wnuk et al. (2009) also indicate a low level of interest in such assets among tourists visiting Polish landscape parks. Tourists often stress the poor promotion of these assets and sites; this was the case with Łuk Mużakowa Geopark, W Poland (Sołogub 2008). Poor knowledge about the tourist value of geological and geomorphological heritage among the providers of tourist services should also be noted. For instance, the term 'geotourism' is familiar to only 33 % of organisers for

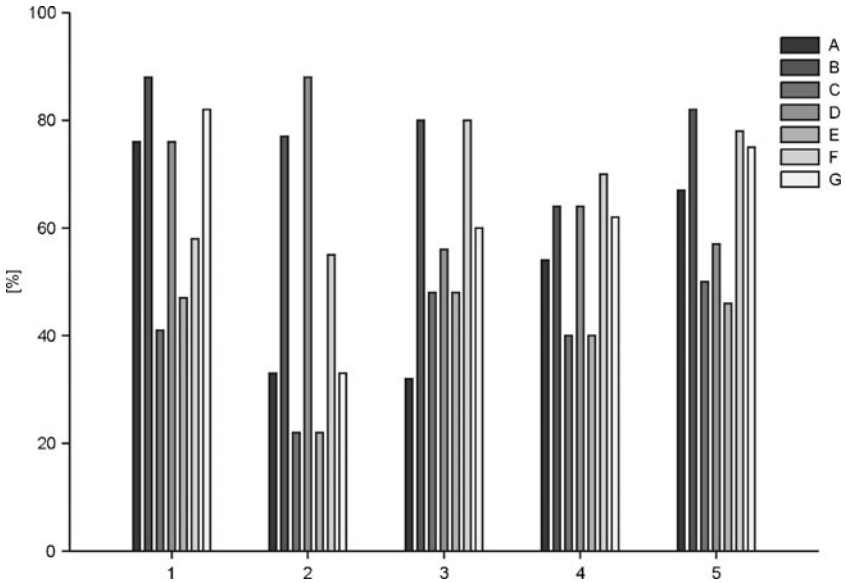

Fig. 4 Type of tourism versus willingness to visit. *1* Short bike trip, *2* hiking trip during a short stay, *3* hiking trip during a stay longer than 2 days, *4* car trip, *5* other, *A* Małopolski Vistula River Gap, *B* loess gullies in the vicinity of Kazimierz Dolny, *C* escarpment in Dobre, *D* hills and gullies in the vicinity of Szczebrzeszyn, *E* Chełm Hills, *F* Tanew, Szum and Sopot river valleys, *G* Bug river valley

educational tourism in Łódzkie province (central Poland) (Majewska and Wiśniewska 2011).

Familiarity with a given area results in a better rating given to it by tourists. Similar patterns were observed in studies concerning the Polish national parks (Zgłobicki et al. 2005). Therefore, the promotion of geomorphosites should be part of broader projects aimed at developing tourism in poorly developed areas: geomorphological heritage will then be discovered accidentally, in conjunction with visits to destinations of a different kind.

The statistical data collected is relevant mostly for the group of young, active, university graduates—a society of Web users. Now and in the future, this environment will play an important role in forming opinions. For instance, studies conducted in the Stołowe Mountains (Table Mountains) show that people aged under 40 accounted for 70 % of the respondents visiting this national park (Prószyńska-Bordas 2011).

The Internet was the main source of information for the respondents about the environment of the places visited. Similar data was obtained in studies concerning the geological heritage of Kielce where the Internet was a source of knowledge for 70 % of the respondents (Wójtowicz 2011b). This compares with only 30 % of tourists visiting Świętokrzyski NP (Prószyńska-Bordas and Seler 2009). Very often, people visit sites of great geotouristic value 'without preparation' or they rely solely on the opinions of their friends (Kozłowski and Nowak 1998). Undoubtedly, the results of the survey brought to attention the need to put an effort into online promotion of geomorphological values.

There was high correlation between sources of information and familiarity with geomorphosites and geomorphological terms. The lack of interest in the studied sites among students is surprising—they do not seek information in any sources other than the Internet, and the percentage of respondents who do not seek information at all is twice as high among students compared to other groups. To some extent, this results from the fact that students have the most extensive knowledge. However, the general level of knowledge about geological and geomorphological heritage is not as high among students, e.g. only 40 % of geography students from Kielce were able to provide the definition of a geopark (Wójtowicz 2011a). The lack of knowledge of geology in society is also indicated by the results of other studies (George Street Research 2006).

The level of knowledge declared by the respondents when questioned about the origin of selected geomorphological forms seems overstated. The need for cautious interpretation of the results is confirmed by responses regarding familiarity with two sites that are located nearby: loess gullies were visited by 65 % of the respondents, while only 25 % declared they visited the Małopolski Vistula River Gap. This shows that 40 % of the respondents do not realise that, on their way to Kazimierz, they passed the Vistula River Gap.

Worth emphasising is the more frequent usage of geomorphological values in the development and promotion of some parts of Lubelskie province. In the area of Nałęczów Plateau, gullies are a landmark of the loess areas and they are used in the promotion of the area among tourists, thanks to the activity of the local tourist organisation *Land of Loess Gullies* (http://www.kraina.org.pl/).

Intensified promotion of those sites would create an opportunity not only for better distribution of tourist traffic, resulting in taking the strain off overcrowded places, but also could improve the level of geological and geomorphological knowledge in society. There are several forms of the management of geotourism: geotourist routes, viewpoints, climbing schools, campsites, didactic parks and museums (Mrowczyk et al. 2011; Pieńkowski 2011). As Reynard (2008) rightly observes, 'the knowledge on needs of geotourists is still quite limited among the geoscientific community'.

Conclusions

1. The study showed that most of the respondents knew (had visited) the most valuable areas in terms of geomorphological heritage in Lubelskie province. The familiarity with the geomorphosites showed considerable variation. Sites located close to popular tourist destinations were visited most frequently.
2. Loess gullies, relief forms associated with indirect human impact on the environment, were the best known among tourists, and they were given the highest rating. Tourist infrastructure was not a significant factor influencing the rating.
3. Landscape (aesthetic) values were the main motivation for the visits. Sites of great scientific and cognitive value often do not arouse the interest of tourists. Familiarity with the sites (i.e. previous visits) leads to a better rating given by tourists.
4. The Internet is the main source of information on geotourist assets. Therefore, it should be the most important tool in the promotion of these assets among tourists.
5. Further research should focus on on-site surveys among tourists visiting geomorphological heritage sites. There is a need for in-depth studies on factors influencing a favourable evaluation of geomorphosites. The knowledge of the region's geotourist potential held by representatives of the local government should also be studied.

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Appendix

Questions of the Internet survey

Q1. Have you ever been to the following places in Lubelskie province?

a) The Kazimierz Dolny and Nałęczów area, b) Western and Central Roztocze (Szczebrzeszyn, Zwierzyniec, Susiec), c) the eastern part of the region (the Chełm and Bug valley area)

Q2. Have you ever visited the following places in Lubelskie province for tourist purposes?

a) Małopolski Vistula River Gap, b) Loess gullies in the Kazimierz Dolny area, c) Escarpment in Dobre, d) Hills and gullies in the Szczebrzeszyn area, e) Chełm Hills - Rejowiec Fabryczny area, f) Valleys of the Tanew, Szum and Sopot, g) Valley of the Bug - from Dubienka to Włodawa

Q3. When you visited these places, what kind of trip was it?

a) a short bicycle trip, b) a hiking trip during a short stay, c) a hiking trip during a stay lasting more than 2 days, d) a car trip, e) another kind, f) I have never been to the places mentioned above

Q4. What was the main motivation for visiting the places mentioned above?

a) landscape (aesthetic) value, b) environmental value, c) cultural value, d) good tourist infrastructure, e) other, f) I have never been to these places

Q5. Can you explain how the following came into being?

a) loess gullies, b) river gaps, c) waterfalls, d) inselbergs, e) structural escarpments, f) old river beds

Q6. Where do you mainly search for information on nature, culture and tourist attractions of the places you visit?

a) scientific and popular-science publications, b) tourist guides, c) films, d) Internet, e) I do not search for such information

Q7. Where would you take your friends on a tour?

a) Małopolski Vistula River Gap, b) Loess gullies in the Kazimierz Dolny area, c) Escarpment in Dobre, d) Hills and gullies in the Szczebrzeszyn area, e) Chełm Hills - Rejowiec Fabryczny area, f) Valleys of the Tanew, Szum and Sopot, g) Valley of the Bug - from Dubienka to Włodawa

Q8. Photographs (rating the attractiveness of places)

Would you like to visit the places shown on the photograph (7 photographs, Fig. 2)?

a) definitely yes, b) probably yes, c) probably not, d) definitely not, e) I do not know

Q9. How many photographs, on average, have you taken during you stay in the places mentioned in Q2?

a) <5, b) 5-10, c) 10-20, d) > 20, e) I do not take photographs, f) I have never been to these places

References

Alexandrowicz Z (2006) Framework of European geosites in Poland. Nat Conserv 62(5):63–87

Alexandrowicz Z, Alexandrowicz SW (2002) Geoturystyka a promocja dziedzictwa geologicznego. In: Partyka J (ed) Użytkowanie turystyczne parków narodowych. Ruch turystyczny—zagospodarowanie—konflikty—zagrożenia. IOP PAN, Ojcowski Park Narodowy, Ojców, pp 91–97

Alexandrowicz Z, Kućmierz A, Urban J, Otęska-Budzyn J (1992) Evaluation of inanimate nature of protected areas and objects in Poland. Polish Geological Institute, Warsaw (in Polish)

Bruschi VM, Cendrero A, Cuesta Albertos JA (2011) A statistical approach to the validation and optimisation of geoheritage assessment procedures. Geoheritage 3:131–149

Brzezińska-Wójcik T, Harasimiuk M (2010) Selected features of natural environment of the Roztocze macroregion. In: Warowna J, Schmitt A (eds) Human impact on upland landscapes of the Lublin region. Kartpol, Lublin, pp 39–56

Brzezińska-Wójcik T, Harasimiuk M, Kociuba W (2009) Conservation of the geological heritage in the Roztocze International Biosphere Reserve (Polish and Ukrainian borderland area). Studia Universitatis Babeş-Bolyai, Geologia, Special Issue, MAEGS 16:52–55

Clay GR, Daniel TC (2000) Scenic landscape assessment: the effects of land management jurisdiction on public perception of scenic beauty. Landsc Urban Plan 49:1–13

Dobek K (2011) Natural curiosities of the Mielnik commune as a chance for geotourism development. Problemy Ekologii Krajobrazu 27:123–129 (in Polish)

Dobrowolski R (1998) Structural conditions of recent karst relief development in the middle Wieprz and Bug interfluve. Maria Curie-Sklodowska University, Lublin (in Polish)

Dotterweich M, Rodzik J, Zgłobicki W, Schmitt A, Schmidtchen G, Bork H-R (2012) High resolution gully erosion and sedimentation processes, and land use changes since the Bronze Age and future trajectories in the Kazimierz Dolny area (Nałęczów Plateau, SE-Poland). Catena 95:50–62

Feuillet T, Sourp E (2011) Geomorphological heritage of the Pyrenees National Park (France): assessment, clustering, and promotion of geomorphosites. Geoheritage 3:151–162

George Street Research (2006) Geotourism in Scotland—evaluation and development. Phase 2—Knockan Crag customer survey. Scottish Natural Heritage Commissioned Report No. 170 (ROAME No. F04AC104/2)

Harasimiuk M (1980) Rzeźba strukturalna Wyżyny Lubelskiej i Roztocza. Rozprawa habilitacyjna. Maria Curie-Skłodowska University, Lublin

Harasimiuk M, Nowak J, Superson J (2008) Budowa geologiczna i rzeźba terenu. In: Uziak S, Turski R (eds) Środowisko przyrodnicze Lubelszczyzny. Lubelskie Towarzystwo Naukowe, Lublin, pp 9–73

Harasimiuk M, Domonik A, Machalski M, Pinińska J, Warowna J, Szymkowiak A (2011) Małopolska Gap of Vistula River—projected geopark. Przegl Geol 59(5):405–416 (in Polish)

Hose TA (1995) Selling the story of Britain's stone. Environmental Interpretation 10:16–17

Hull RB, Buyhoff GJ (1984) Individual and group reliability of landscape assessments. LandscPlan 11:67–71

Kołodyńska-Gawrysiak R, Jezierski W, Kozieł M (2010) The structural escarpment in Dobre: an area of unique environmental value strongly transformed by gully erosion. In: Warowna J, Schmitt A (eds) Human impact on upland landscapes of the Lublin region. Kartpol, Lublin, pp 171–178

Kondracki J, Richling A (1994) Regiony fizycznogeograficzne. In: Atlas Rzeczypospolitej Polskiej. Warszawa.

Kozłowski M, Nowak E (1998) Walory turystyczne Chęcińsko-Kieleckiego Parku Krajobrazowego i kierunki ich wykorzystania w świetle wyników badań ankietowych. In: Rzętała M, Szczypek T (eds) 47 Zjazd Polskiego Towarzystwa Geograficznego, Sosnowiec, 23–26 września 1998 r, Geografia w kształtowaniu i ochronie środowiska oraz transformacji gospodarczej regionu górnośląskiego, II Referaty, komunikaty, postery. Silesian University, Sosnowiec, pp 361–363

Lange E, Hehl-Lange S, Brewer M (2008) Scenario-visualization for the assessment of perceived green space qualities at the urban–rural fringe. J Environ Manag 89:245–256

Lothian A (1999) Landscape and the philosophy of aesthetics: is landscape quality inherent in the landscape or in the eye of the beholder? Landsc Urban Plan 44:177–198

Majewska A, Wiśniewska M (2011) Geotourism in natural value areas in Łódź Region and its position in tourist offices offer. Studia i Materiały CEPL w Rogowie 13 3(28):134–138 (in Polish)

Maruszczak H (1972) Wyżyny Lubelsko-Wołyńskie. In: Klimaszewski M (ed) Geomorfologia Polski. PWN, Warszawa, Poland, pp 340–384

Maruszczak H (1973) Gully erosion in the eastern part of southern uplands of Poland. Zesz Probl Post Nauk Roln 151:15–30 (in Polish)

Maruszczak H (1995) Glacial cycles of loess accumulation in Poland during the last 400 ka and global rhythms of palaeogeographical events. Ann UMCS, B 50:127–156

Migoń P (2008) Geomorfologia w ochronie dziedzictwa przyrodniczego i kulturowego—wymiar globalny. Landf Anal 9:25–29

Migoń P (2009) Geomorphosites and the World Heritage List of UNESCO. In: Reynard E, Coratza P, Regolini-Bissig G (eds) Geomorphosites. Pfeil, Munchen, pp 119–130

Mrowczyk P, Madeja G, Doktor M (2011) National park geotourism infrastructure development on the example of Five Ponds Valley, Polish Tatra Mountains. Problemy Ekologii Krajobrazu 27:473–476

Newsome D, Dowling RK (2010) Geotourism: the tourism of geology and landscape. Goodfellow, Oxford

Papińska E, Białkowska-Jelińska E (2010) Landscape values as a determinant in geotourism development: a case study of Utah, USA. Prace Komisji Krajobrazu Kulturowego PTG 14:138–153 (in Polish)

Panizza M (2001) Geomorphosites: concepts, methods and example of geomorphological survey. Chinese Science Bulletin 46(Suppl. Bd.):4–6

Pena dos Reis R, Henriques MH (2009) Approaching in integrated qualification and evaluation system for geological heritage. Geoheritage 1:1–10

Pieńkowski G (2011) Geological museums and theme parks—mainspring of education, development and business. Przegl Geol 59 (4):323–328 (in Polish)

Pralong JP (2006) Géotourisme et utilisation de sites naturels d'intérêt pour les sciences de la Terre. Les régions de Crans-Montana-Sierre (Valais, Alpes suisses) et Chamonix-Mont-Blanc (Haute-Savoie, Alpes françaises). Travaux et Recherches no. 32, Lausanne, Institut de Géographie

Prószyńska-Bordas H (2011) Preparation of geological attractions for tourism and geological knowledge among tourists visiting Polish geosites based on the example of the Stołowe Mountains and the Świętokrzyski National Parks. In: Słomka T (ed) Geotourism—a variety of aspects. AGH University of Science and Technology, International Association for Geotourism, Kraków, pp 39–54

Prószyńska-Bordas H, Seler M (2009) Types of visitors in Świętokrzyski National Park. Studia i Materiały Centrum Edukacji Przyrodniczo-Leśnej 11 4(23):218–226 (in Polish)

Quaranta G (1993) Geomorphological assets: conceptual aspect and application in the area of Crodo da Lago (Cortina d'Ampezzo, Dolomites). In: Panizza M, Soldati M, Barani D (eds) European intensive course on applied geomorphology. Proceedings, Modena–Cortina d'Ampezzo, 24 June–3 July 1992, pp 49–60

Regional Directorate for Environmental Protection in Lubli'n [Regionalna Dyrekcja Ochrony Środowiska w Lublinie]. Available at http://lublin.rdos.gov.pl/. Accessed 21 May 2012

Reynard E (2005) Géomorphosites et paysage. Géomorphologie. Relief, processus, environnment 3/2005:181–188

Reynard E (2008) Scientific research and tourist promotion of geomorphological heritage. Geogr Fis Dinam Quat 31(2008):225–230

Reynard E, Coratza P (2007) Geomorphosites and geodiversity: a new domain of research. Geogr Helv 62:138–139

Rodzik J, Ciupa T, Janicki G, Kociuba W, Tyc A, Zgłobicki W (2008) Współczesne przemiany rzeźby Wyżyn Polskich. In: Starkel L, Kostrzewski A, Kotarba A, Krzemień A (eds) Współczesne przemiany rzeźby Polski. IGiGP UJ, pp 165–228

Roth M (2006) Validating the use of Internet survey techniques in visual landscape assessment—an empirical study from Germany. Landsc Urban Plan 78:179–192

Słomka T, Kicińska-Świderska A (2004) Geoturystyka—podstawowe pojęcia. Geoturystyka 1:5–7

Sołogub A (2008) The Muzakowski Park touristic values. Badania Fizjograficzne nad Polską Zachodnią, A 59:161–177 (in Polish)

Turczyński M, Michalczyk Z, Bochra A (2006) River lakes in the Lublin region. Teka Kom Ochr Kszt Środ Przyr 2006(3):231–240

Warowna J (2010) Transformation of the Vistula river channel in relation to human activity (the Zawichost–Puławy gap section). In: Warowna J, Schmitt A (eds) Human impact on upland landscapes of the Lublin region. Kartpol, Lublin, pp 145–161

Wherrett JR (1999) Issues in using the Internet as a medium for landscape preference research. Landsc Urban Plan 45:209–217

Wnuk Z, Ziaja M, Mazur-Rylska A, Guzik C (2009) Landscape parks in survey research. In: Wnuk Z, Ziaja M (eds) Turystyka w parkach krajobrazowych. Rzeszów University, Rzeszów, pp 43–50 (in Polish)

Wójtowicz B (2011a) The possibility of development of tourism and education in areas of geological parks based on the opinion of students of geography UJK in Kielce. Problemy Ekologii Krajobrazu 29:133–140 (in Polish)

Wójtowicz B (2011b) The attitude and expectation of the local community toward development of geological tourism in protected areas near the city of Kielce and the Świętokrzyski region. Problemy Ekologii Krajobrazu 29:123–132 (in Polish)

Zgłobicki W, Baran-Zgłobicka B (2011) Gullies as an indicator of human impact on loess landscape (Case study: North Western part of Lublin Upland, Poland). Zeitschrift für Geomorphologie 55(Suppl. 1):119–137

Zgłobicki W, Baran-Zgłobicka B, Ziółek M, Ziółek G (2005) Scenic beauty of Polish National Parks landscape and their natural values. Parki Narodowe i Rezerwaty Przyrody 24:135–151 (in Polish)

Zgłobicki W, Brzezińska-Wójcik T, Gawrysiak L, Harasimiuk M (2007) Geomorphosites of Lublin region as a tool for the development of geotourism. In: Harasimiuk M, Brzezińska-Wójcik T, Dobrowolski R, Mroczek P, Warowna J (eds) Geological structure of Lublin region and problems of lithosphere conservation. Maria Curie-Sklodowska University, Lublin, pp 271–277 (in Polish)

Zgłobicki W, Kołodyńska-Gawrysiak R, Gawrysiak L, Pawłowski A (2012) Geotourism assets of loess relief in western part of the Lublin Upland. Przegl Geol 60(1):26–31 (in Polish)

Zube EH, Sell JL, Taylor JG (1982) Landscape perception: research, application and theory. Landscape Planning 9:1–33